# CALIBRATION STANDARD SPECIFICATION

# FOR A

# LOGIC ANALYZER/DIGITAL OSCILLOSCOPE

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# PROCUREMENT PACKAGE

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## 1. SCOPE

1.1 Scope. This specification defines the mechanical, electrical, and electronic characteristics for a Logic Analyzer/Digital Oscilloscope. This equipment is intended to be used by Navy personnel in shipboard and shorebased laboratories. For the purposes of this specification, the Logic Analyzer/Digital Oscilloscope shall be referred to as the Analyzer.

## 2. APPLICABLE DOCUMENTS

2.1 Controlling Specifications. MIL-T-28800, "Military Specification, Test Equipment for use with Electrical and Electronic Equipment, General specification for," and all documents referenced therein of the issues in effect on the date of this solicitation shall form a part of this specification.

## 3. REQUIREMENTS

3.1 General. The Analyzer shall conform to the Type II, Class 5, Style E requirements as specified in MIL-T-28800 for Navy shipboard and shorebased use as modified below. The use of material restricted for Navy use shall be governed by MIL-T-28800.

3.1.1 Design and Construction. The Analyzer design and construction shall meet the requirements of MIL-T-28800 for Type II equipment.

3.1.2 Power Requirements. The Analyzer shall operate from a source of 103.5V to 126.5V at 50 Hz and 60 Hz ±5% single phase input power as specified in MIL-T-28800.

3.1.2.1 Fuses or Circuit Breakers. Fuses or circuit breakers shall be provided. If circuit breakers are used, both sides of the power source shall be automatically disconnected from the equipment in the event of excessive current. If fuses are used, only the line side of the input power line as defined by MIL-C-28777 shall be fused. Fuses or circuit breakers shall be readily accessible.

3.1.2.2 Power Connections. The requirements for power source connections shall be in accordance with MIL-T-28800 with a 6 foot minimum length cord.

3.1.3 Dimensions and Weight. The maximum dimension of the Analyzer shall not exceed 19 inches in width, 12 inches in height, 25 inches in depth. The weight of the Analyzer shall not exceed 44 pounds.

3.1.4 Lithium Batteries. Per MIL-T-28800, lithium batteries are prohibited without prior authorization. A request for approval

for the use of lithium batteries, including those encapsulated in integrated circuits, shall be submitted to the procuring activity at the time of submission of proposals. Approval shall apply only to the specific model proposed.

3.2 Environmental Requirements. The Analyzer shall meet the environmental requirements for a Type II, Class 5, Style E equipment with the deviations specified below.

3.2.1 Temperature and Humidity. The ANALYZER shall meet the conditions below:

| | Temperature(°C) | Relative Humidity (%) |
|---|---|---|
| Operating | 10 to 30 | 95 |
| | 30 to 40 | 75 |
| Non-operating | -40 to 70 | Not Controlled |

3.2.2 Electromagnetic Compatibility. The electromagnetic compatibility requirements of MIL-T-28800 are limited to the following areas: CE01, CE03, CS01, CS02 (0.05 to 100 MHz), CS06, RE01 (back panel search excluded), RE02 (14 kHz to 1 GHz), and RS03.

3.3 Reliability. Type II reliability requirements are as specified in MIL-T-28800.

3.3.1 Calibration Interval. The Analyzer shall have an 85% or greater probability of remaining within tolerances of all specifications at the end of a 12 month period.

3.4 Maintainability. The Analyzer shall meet the Type II maintainability requirements as specified in MIL-T-28800 except the lowest discrete component shall be defined as a replaceable assembly. Certification time shall not exceed 60 minutes.

3.5 Performance Requirements. The analyzer shall provide the following capability as specified below. Unless otherwise indicated, all specifications shall be met following a 30 minute warm-up period.

3.5.1 Organization and Components. The analyzer includes three integral subsystems: two State/Timing Analyzers, and an Oscilloscope. Each subsystem shall be triggerable by events detected by the other two subsystems and all three subsystems shall display their results on a common CRT.

3.5.1.1 Input Channels.

3.5.1.1.1 Logic Inputs. The Analyzer shall have at least 80 channels usable by the State Analyzer and/or the Timing Analyzer.

3.5.1.1.1.1 Input Impedance. The input impedance of the Analyzer shall be 100K ±2% in parallel with <10 pF.

3.5.1.1.1.2 Grouping. The Analyzer shall have five groups of 16 channels each, labeled 1 through 5 for the purpose of this specification. Each group is separately assignable to either analyzer 1 or 2.

3.5.1.1.1.3 Threshold Voltage. Adjustable over the range ±9.9V with a resolution of ±0.1V and an uncertainty of no more than 300 mV. Adjustable separately for groups 1,2, and 3; 4 and 5 have the same threshold.

3.5.1.1.1.4 Transition Sensitivity. The transition sensitivity shall not exceed 600 mV.

3.5.1.1.2 Analog Inputs. The Analyzer shall have at least two BNC connectors providing signals to the Oscilloscope.

3.5.1.2 Memory. The Analyzer shall have at least 1000 points memory for each logic channel. The Oscilloscope shall have at least 2000 points of waveform memory.

3.5.2 State Analyzer

3.5.2.1 Clocking. The state input clock rate shall be at least 35 MHz, or 16 MHz when Time/Event Tagging is on.

3.5.2.2 Pattern Recognizers. A combination of (1, 0, X (don’t care)) applied to the input channels. A least 4 pattern recognizers shall be available to each state analyze.

3.5.2.3 Numeric Recognizer. The Analyzer shall have up to 32 channels may be interpreted as a binary number which is compared between two numeric thresholds.

3.5.2.4 Qualifier. For purposes of this specification, a qualifier is any combination o f pattern and Numeric recognizers or “any,’ which will match any state.

3.5.2.5 Sequencing. The Analyzer shall have up to 64000 times before advancing to the next.

3.5.2.6 Storage. Each state matching a qualifier may be stored.

3.5.2.7 Trigger Word. Any combination of channels, up to all 80.

3.5.2.8 Event/Timing Tagging. The event/timing tagging shall be up to 4000 qualified states between stored states shall be recorded.

3.5.2.8.1 Event Tagging. The event tagging shall be up to 4000 qualified states between stored states shall be recorded.

3.5.2.8.2 Timing Tagging. The timing Tagging shall measures the time between stored states, between 60 ns and 48 hours.

3.5.3 Timing Analyzer.

3.5.3.1 Acquisition Modes.

3.5.3.1.1 Transition Mode. Samples are taken every 10 ns ±0.01%, but are stored only when the data have changed from the previous sample, up to 5000 seconds total time.

3.5.3.1.2 Glitch Mode. Samples are taken and stored every sample period.

3.5.3.1.2.1 Sample Period. The sample period shall be at least from 20 ns to 50 ms in a 1-2-5 sequence with an uncertainty of ±0.01%.

3.5.3.1.2.2 Time Covered. The time shall cover at least 500 samples.

3.5.3.2 Display.

3.5.3.2.1 Time Range. The display time range shall be from 10 ns/div. to 100s/div. in a 1-2-5 sequence with a resolution of ±0.01%.

3.5.3.2.2 Number of traces. The display traces shall be at least 24. Multiple channels may be displayed on a single line.

3.5.3.2.3 Display modes. The display modes shall be selectable whether the display is erased between acquisitions.

3.5.3.2.4 Channel-to-Channel Timing Uncertainty. The channel-channel timing uncertainty shall not exceed 5 ns.

3.5.3.3 Trigger. Based on a pattern over at least a minimum duration but not longer than a maximum duration.

3.5.3.3.1 Pattern. Combination of (0, 1, X (don’t care)) for each channel.

3.5.3.3.2 Minimum Duration. The minimum duration shall be selectable between 30 ns to 10 ns with a resolution of ±0.01% (but at least 10 ns). The uncertainty is -20 to +0 ns.

3.5.3.3.3 Maximum Duration. The maximum duration shall be selectable between 40 ns to 10 ms with a resolution of ± 0.01% (but at least 10 ns) . The uncertainty is -0 to +20 ns.

3.5.3.3.4 Glitch. Trigger on glitch or edge following a pattern of minimum duration while the patter is still present.

3.5.4 Oscilloscope. The oscilloscope subsystem shall be a dual channel digital storage oscilloscope.

3.5.4.1 Vertical Input Channels. The two vertical input channels shall be referred to as “A’ and “B” for the purposes of this specification. All specifications apply to both channels. The two channels’ setting are totally independent.

3.5.4.1.1 Input Impedance. The oscilloscope input impedance shall be selectable between 1M ±1% in parallel with no more than 10 pf and 50 ±1%.

3.5.4.1.2 Sensitivity. The oscilloscope sensitivity shall be from 50 mV/div. to 10V/div. in at least 1-2-5 sequence and an uncertainty of no greater than ±3% of full scale.

3.5.4.1.3 Offset. The offset shall be variable over at least ±40 divisions with a resolution of at least 2% of setting. With the 50 input impedance selected, the offset may be no greater than ±5V. The uncertainty shall be no greater than ±(2% of setting + 2.5% of full scale + 2 mV).

3.5.4.1.4 Input Voltage. The analyzer shall suffer no degradation of performance with 250V peak applied to an input with a 1 M impedance or 5V applied to an input with a 50 impedance.

3.5.4.1.5 Resolution. Each channel shall have at least 6 bits of resolution.

3.5.4.1.6 Bandwidth. The bandwidth of the oscilloscope shall be at least DC to 100 MHz.

3.5.4.1.7 Sampling Rate. The oscilloscope sampling rate shall be at least 400 ms/s (real time).

3.5.4.1.8 Channel Isolation. The channel isolation shall be at least 40 dB up to 50 MHz and at least 30 dB from 50 MHz to 100 MHz.

3.5.4.1.9 Measurement Functions. The measurement function shall have the ability to add and subtract the A and B channel waveforms: rise time, fall time, pulse width, period, peak to peak voltage, and overshoot.

3.5.4.2 Horizontal Time Base.

3.5.4.2.1 Sweep Rate. The sweep rate shall be at least 5 ns/div. to 5 s/div. in a 1-2-5 sequence.

3.5.4.2.2 Pre- and Post-Trigger Viewing. The pre and post trigger viewing shall be at least ±40 divisions.

3.5.4.3 Triggering.

3.5.4.3.1 Arming. The arming shall be selectable between the State/Timing Analyzer 1 or 2, external TTL-level BNC input, or always.

3.5.4.3.2 Trigger Event. The trigger event shall be selectable between , at least, rising, or falling edge of channel A or B, and immediately after arming.

3.5.4.3.3 Trigger Level. The trigger level shall be adjustable over at least ±6 divisions from the DC offset level with a resolution given by the following table.

| Vertical Gain | Trigger Resolution |
|---|---|
| 50 mV/div. or less | 400 μV |
| 100-200 mV/div. | 2 mV |
| 500 mV/div. - 1 V/div. | 10 mV |
| 2 V/div. or more | 50 mV |

3.5.4.4 Cursors. There shall be at least 2 cursors that track a selected channel's display waveforms. The two cursors shall have different symbols to easily differentiate between them.

3.5.4.4.1 Voltage Readings. The voltage level at each cursor shall be display data the same resolution and uncertainty as the vertical channels.

3.5.4.4.2 Time Readings. The time difference between the two cursors shall be displayed to an uncertainty of no more than:

±(2% of s/div. setting + 0.01% of time difference + 500 ps).

3.5.5 Mass Storage. The analyzer shall have a 3 1/2" floppy disk drive. The floppy disk drive shall be used to store and recall instrument configurations.

3.5.6 Hard Copy. The analyzer shall support hard copy to an HP-PCL or EPSON FX-80 compatible printer through the IEEE-488 interface and through an RS-232 interface.

3.6 Operational Requirements.

3.6.1 Front Panel Control Requirements. All modes and functions shall be operable using front panel controls. The locations and labeling of indicators, controls, switches shall provide for maximum clarity and easily understood operation without reference to tables, charts, or flow diagrams.

3.6.2 Programmability. All modes and functions shall be fully remotely programmable via the IEEE-488.1 instrumentation bus. When operating the Analyzer via remote programming, all front panel controls shall be disabled, except for the on/off switch and the remote/local switch.

3.6.3 Local/Remote. The analyzer shall have a local and remote operation mode. It shall be either manually or remotely programmable selectable according to paragraph 3.6.2. Manual selection shall be provided by a front panel switch. A means of indicating the operational mode shall be provided.

3.6.4 Self-Test. The self test shall comprise two selectable levels, an operational test to determine if the instrument is operationally ready, and a second level diagnostic test to diagnose and isolate faulty field replaceable modules. When the self test function is initiated, an auto sequenced internal operation test shall be performed. The diagnostic test shall be selectable only by deliberate operator command.

3.6.5 IEEE Interface. The analyzer shall have an IEEE-488.1 interface connector with the following capabilities: SH1, AH1, T6, L4, SR1, RL1, DT1. Serial poll capability shall be provided.

3.6.6 Compatibility. The analyzer shall be tested for compatability with the IEEE-488 bus and the John Fluke model 1722A/AP instrument controller.

3.7 Manual. At least two copies of an operation and maintenance manual shall be provided. The manual shall meet the requirements of MIL-M-7298.

3.7.1 Calibration Procedure. The manual shall provide a Analyzer calibration procedure in accordance with MIL-M-38793.

3.8 Accessories. The Analyzer shall include at least one lead for each logic channel, grouped as specified in 3.5.1.1.1.2, one for each group.